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IS 3415 (1998): Glossary of terms used in magnetic particle
flaw detection [MTD 21: Non-Destructive Testing]



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भारतीय मानक
चुम्बकीय कण द्वारा दोष संसूचन में
प्रयुक्त पारिभाषिक शब्दावली
(दूसरा पुनरीक्षण)

Indian Standard

GLOSSARY OF TERMS USED IN MAGNETIC
PARTICLE FLAW DETECTION
(*Second Revision*)

ICS 19.160

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FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Non-Destructive Testing Sectional Committee had been approved by the Metallurgical Engineering Division Council.

This standard was first published in 1966 and was subsequently revised in 1980. In this revision, definitions of a number of new terms have been added and the definitions of a number of terms have been modified in the light of the latest technological developments in the field. It is hoped that this standard would help to remove any ambiguity and confusion arising out of individual interpretations of different terms in this field.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2:1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

GLOSSARY OF TERMS USED IN MAGNETIC PARTICLE FLAW DETECTION

(Second Revision)

1. SCOPE

This standard defines the terms commonly used in magnetic particle flaw detection.

2 TERMS AND DEFINITIONS

2.1 Alternating Current

A current with a periodically varying amplitude of which the mean value is zero. Commonly used in the abbreviated form as a.c.

2.2 Alternating Current Impulse

Alternating current of short duration.

2.3 Alternating Current Magnetization

Magnetization induced by an alternating current.

2.4 Arc

A luminous high temperature discharge produced under an electric potential formed across a gap between electrodes or between an electrode and component surface.

2.5 Background

The area against which a flaw indication is sought, after the application of magnetic particles.

2.6 Background Paint

A paint applied to a surface prior to magnetic particle examination to increase contrast and thus to facilitate observation of an indication.

2.7 Black Light

Near ultra violet radiation (wave length 330 to 390 nm) used for exciting fluorescence in magnetic particles.

2.8 Black Light Filter

A filter capable of transmitting the ultra violet radiation of wave length in the region of 330 to 390 nm while absorbing other wave length.

2.9 Burning

Local overheating of the component at the contest area arising from the production of an arc or from high resistance.

2.10 Captive Fluid Indicator

A device comprising, a quantity of magnetic fluid sealed in a transparent plastic container, the fluid behaving in the same way on a magnetized component as free magnetic fluid.

2.11 Carrier Fluid

The fluid in which magnetic particles are suspended to facilitate the application of the particles.

2.12 Central Conductor

A conductor passed through a hollow part and used for producing circular magnetization.

2.13 Circumferential Magnetization

Title is changed to circular magnetization which causes a flux to have directions parallel to the periphery of a component when current is passed along its longitudinal axis.

2.14 'Clip-on' Ammeter

A portable instrument for measuring the current flowing in a conductor without breaking the circuit.

2.15 Coagulation

The agglomeration of magnetic particles in a suspension.

2.16 Coercive Force

A magnetic field strength required to be applied in the direction opposite to residual magnetization to demagnetize ferromagnetic materials.

2.17 Coil Method

A method of magnetization in which part or whole of the component is encircled by a current carrying coil. The use of the terms is usually restricted to instances in which the component does not provide a closed magnetic circuit for all the fluxes generated.

2.18 Colour Contrast Particle

Magnetic particles which are visible due to their colour which distinguish them from the component surface.

2.19 Coloured Magnetic Inks

Fluids containing magnetic particles producing an indication other than black.

2.20 Compass Test

A test for demagnetization carried out by placing the magnetic compass needle in specified positions in relation to a component and ascertaining that the consequent deflection does not exceed a specified maximum.

2.21 Contact Head

The electrode assembly used to a clamp and support a part/conductor to facilitate passage of electrical current through the part/conductor for circular magnetization.

2.22 Contact Pads

Replaceable metal pads, usually of copper braid, placed an electrodes to give good electrical contact, thereby preventing damage to the component under test.

2.23 Continuous Method

A method of inspection where the indicating medium is applied to the component while the magnetizing force is present.

2.24 Contrast

The difference in reflectivity or coloration between the background and the flaw as shown by the magnetic particles.

2.25 Contrast Aid

A coating or film applied to a surface to improve contrast by providing a more suitable background.

2.26 Control Specimens

Specimens containing known defects used as a reference for checking the efficiency of magnetic particles flaw detection processes.

2.27 Core of an Electromagnetic Circuit

That part of the magnetic circuit which is within the winding.

2.28 Crow Receiver

A free-standing graduated measure which is mainly cylindrical but tapered towards the bottom to allow greater accuracy in reading small volumes.

2.29 Curie Point

The temperature at which ferromagnetic materials can no longer be magnetized by outside forces, and at which they lose their residual magnetism.

2.30 Current Flow Method

A method of magnetization by passing a current

through a component *via* prods or contact heads the current may be alternating, rectified alternating, or direct.

2.31 Current Induction Machine

A magnetic particle flaw detector which is designed for the induced current flow technique.

2.32 Defect

A flaw which is unacceptable.

2.33 Deep Seated Flaws

Flaws which are located at a depth from the surface of the objects being examined.

2.34 Demagnetization

The reduction in the intensity of residual magnetism in ferromagnetic materials to an acceptable level.

2.35 Demagnetizing Coil

A coil of wire carrying alternating current which is used for demagnetization.

2.36 Diffuse Indications

Indications that are not clearly defined, for example, indications of subsurface defects.

2.37 Direct Current

An electric current flowing in one direction from one electrode to another and sensibly free from pulsation. Commonly known in the abbreviated form as d.c.

2.38 Direct Current Magnetization

Magnetization induced by a direct current.

2.39 Discontinuity

Lack of continuity in the magnetic permeability of the objects being examined.

2.40 Domain

A substructure in ferromagnetic material within which all the elementary magnets (electron spins) are held aligned to one direction by inter-atomic forces.

2.41 Dry Out Time

The time allowed for carrier fluid to evaporate leaving magnetic particles in a dry conditions.

2.42 Dry Powder Method

The method of magnetic particle inspection in which finely divided ferromagnetic particles suitable selected and prepared are used as indicating medium without the use of a carrier liquid.

2.43 Effective Magnetic Permeability

A factor depending on the magnetic permeability (μ) of the component and on demagnetization factor. Its value is less than that of μ .

2.44 Electrode

A conductor by means of which a current passes into or out of the component under examination.

2.45 Electromagnet

A soft iron core surrounded by a coil of wire that temporarily becomes a magnet when an electric current flows through the wire.

2.46 Encircling Coil Method

A method of magnetization in which part or whole of the component is encircled by a current carrying coil. The use of the term is usually restricted to instances in which the component does not provide a closed magnetic circuit for all the fluxes generated.

2.47 Examination

The process of observing the magnetic particle pattern.

2.48 False Indications

Magnetic particles indications that are not due to discontinuities.

2.49 Ferromagnetic

A property of material on account of which only a small amount of applied magnetic force induces in it a large amount of magnetization.

2.50 Flash Magnetization

Magnetization by a current flow of very brief duration.

2.51 Flash Point

The minimum temperature at which a liquid heated in a Cleveland cup (open test) or in a Pensky-Martins apparatus (Closed test) gives off sufficient vapour to flash momentarily on the application of a small flame.

2.52 Flaw

A discontinuity, that is, likely to be as a result of imperfections in materials.

2.53 Flaw Indications

Accumulation of ferromagnetic particles along the leakage flux areas arising due to discontinuities.

2.54 Fluorescence

The emission of visible radiation by a substance as

the result of and only during, the absorption of black light radiation.

2.55 Fluorescent Magnetic Fluid

A fluid containing magnetic particles coated with fluorescent dyes.

2.56 Fluorescent Particles

Magnetic particles coated with fluorescent dye.

2.57 Flux

See Magnetic Flux (2.84).

2.58 Flux Density

See Magnetic Flux Density (2.85).

2.59 Flux Meter

See Magnetic Field Meter (2.80).

2.60 Flux Penetration

The depth to which a magnetic flux is effective in a component.

2.61 Full Wave Rectified Current

When the reverse half cycle of an alternating current is turned around to flow in the same direction as the forward half, the result is full wave rectified current.

2.62 Furring

Build up of magnetic particles due to excessive magnetization of the component under examination.

2.63 Gauss

The old unit of magnetic field strength now replaced by the tesla, T. A magnetic field is said to be unit strength at any point if a unit pole placed there is acted upon with a force of one dyne.

The intensity of a magnetic field is represented numerically by the number of lines of force per unit area (perpendicular to their direction).

2.64 Gauss Meter

Equipment measuring magnetic field strength or intensity.

2.65 Half Wave Rectified Current

When a single phase alternating current is rectified in the simplest manner, the reverse half of the cycle is blocked out entirely. The result is a pulsating unidirectional current with intervals when no current at all is flowing. This is often referred to as 'half-wave' or as pulsating direct current and is that type

of current most commonly employed in magnetic flaw detection.

2.66 Hysteresis Loop

A curve showing the flux density ' B ' plotted as a function of magnetizing force ' H '. The curve forms a characteristics ' S ' shaped loop. Intercepts of loop with B - H axes, the points of maximum and minimum magnetizing force and the maximum slope of the loop define important magnetic characteristics of a material.

2.67 Indication

Magnetic particle pattern formed over the surface being tested.

2.68 Indirect Magnetization

Magnetization induced in a part when no direct electrical contact is made.

2.69 Induced Current Flow Technique

A method of magnetization in which a circulating current is induced in a ring component by making it in effect the secondary of a mains transformer.

2.70 Induction

See Magnetic Induction (2.86).

2.71 Laminated Pole Pieces

Pole pieces consisting of separately adjustable elements for taking up irregular profiles.

2.72 Leakage Field

See Magnetic Field Leakage (2.79).

2.73 Leakage Flux

The magnetic flux that appears on the surface of the object due to the presence of a discontinuity.

2.74 Longitudinal Magnetization

Magnetization where the flux lines of the field traverse in the component in a direction essentially parallel to its longitudinal axis.

2.75 Magnetic Circuit

A combination of interconnecting media, mainly comprising of ferromagnetic materials, forming a closed circuit for magnetic flux lines.

2.76 Magnetic Field

The volume within and the surrounding either a magnetized part or a current carrying conductor wherein magnetic lines of force, are present.

2.77 Magnetic Field Distribution

The distribution of field strength in a magnetic field.

2.78 Magnetic Field Indicator

An instrument designed to indicate magnetic fields.

2.79 Magnetic Field Leakage

The loss of magnetic field strength due to undesirable discontinuities and changes in section in a magnetic circuit.

2.80 Magnetic Field Meter

An instrument designed to measure the flux density.

2.81 Magnetic Field Strength (H)

The intensity of magnetic field at a point, expressed in A/m (ampere per meter) in SI unit and in Oe (oersted) in cgs system of units.

2.82 Magnetic Flaw Detection Ink

A detecting medium consisting essentially of magnetic particles in a carrier fluid.

2.83 Magnetic Flow Method

A method of magnetic particle inspection, in which no current passes into or out of the component under examination but the flux in it is established by using a threading or encircling conductor (for example, bar, cable or coil) carrying an electric current or by using an electromagnet or permanent magnet.

2.84 Magnetic Flux

It is the product of magnetic flux density and cross sectional area through which the flux lines pass.

2.85 Magnetic Flux Density (B)

It is the total intensity of magnetization in a magnetized component consisting of the contribution due to the applied field and the induced intensity of magnetization.

2.86 Magnetic Induction (B)

It is the total intensity of magnetization in a magnetized component consisting of the contribution due to the applied field and the induced intensity of magnetization.

2.87 Magnetic Leakage Field

The magnetic field, external to a component and in proximity to a discontinuity, which is detectable by magnetic particles.

2.88 Magnetic Particle Flaw Detection

A process for detecting surface or near surface

discontinuities in magnetic materials by the generation of a magnetic flux within a component and the application of suitable magnetic particles to its surface to give an indication of the defect.

2.89 Magnetic Particle Flaw Detector

Equipment providing essentially current or magnetic flux for the purpose of magnetic particle flaw detection. Usually it also facilitate holding components of varying dimensions and for adjusting and reading the magnetizing current.

2.90 Magnetic Permeability

The ratio of the magnetic induction B to the external magnetic field H , causing the induction.

2.91 Magnetic Poles

Points situated near the ends of the magnet where it may be considered that two magnetic masses are situated, such that their resultant field, at a distant point, is approximately the same as that of the magnet.

2.92 Magnetic Powder

Magnetic particles in dry powder form of suitable shape and size for flaw detection purposes.

2.93 Magnetic Saturation

The stage at which any further increase in the magnetic intensity H field applied to a magnetized component will fail to show any significant increase in the magnetic flux in that component. The slope of B - H curve now becomes equal to the magnetic permeability of free space.

2.94 Magnetic Writing

A form of non-relevant indications sometimes caused when the surface of a magnetized part comes in contact with another piece of ferromagnetic material.

2.95 Magnetizing Force

The magnetizing field strength applied to a ferromagnetic material to induce magnetism.

2.96 Magnetometer

See Magnetic Field Meter (2.80).

2.97 Non-Relevant Indication

Magnetic particles pattern that are not due to any material discontinuities.

2.98 Near Surface Flaws

See Subsurface Flaws (2.116).

2.99 Oersted

Unit of magnetic field strength or intensity in cgs system of units.

2.100 Paramagnetic Material

A material with magnetic permeability slightly greater than 1.

2.101 Particle Content

The apparent volume ratio of magnetic particles to carrier fluid of magnetic ink.

2.102 Peak Current

The maximum instantaneous value of the direct or periodic current obtained during examination.

2.103 Permanent Magnet

A magnet that retains a high degree of magnetization virtually unchanged for a long period of time (characteristic of materials with high retentivity).

2.104 Permeability

Same as Magnetic Permeability (2.90).

2.105 Portable Flux Indicator

A specimen containing known defects used for checking the efficiency of magnetic particle flaw detection processes by placing it in contact with the component under examination.

2.106 Prods

Hand held electrodes attached to flexible cables to transmit the magnetizing current from the source to the component under examination.

2.107 Rectified Alternating Current

An electric current obtained by rectifying alternating current without the deliberate addition of smoothing.

2.108 Relevant Indication

Magnetic particle pattern due to a discontinuity in a material.

2.109 Residual Field Method

A method of inspection where the magnetic particles are applied to the component after the magnetizing current is cut off.

2.110 Residual Magnetism

The magnetic field which persist in a ferromagnetic body after the magnetizing force has been removed.

2.111 Retentivity

The ability of a material to retain a portion of the applied magnetic field after the magnetizing force has been removed.

2.112 Settling Time

The time allowed for settlement of magnetic particles in a sample of magnetic ink or bath prior to the assessment of particle content.

2.113 Sensitivity

The degree of capability of a magnetic particle examination technique for indicating surface or near surface discontinuities in ferromagnetic material.

2.114 Skin Effect

The phenomenon that causes the magnetization produced by alternating current to be contained near the surface of a ferromagnetic part.

2.115 Surface Discontinuity

A discontinuity in the material which starts from the surface.

2.116 Subsurface Flaws

Flaws which are located just below the surface but not open to the surface.

2.117 Surface Field

The magnetic field at the surface of the component under examination.

2.118 Sutherland Flask

A graduated tapered glass flask used for measuring the apparent proportion of solids separating under gravity from a known volume of magnetic particle flaw detection ink. The ungraduated upper portion like an inverted pear, is constricted at the top receiver stopper and blended at the bottom into a graduated tube of small uniform sections.

Tesla — The SI Unit of magnetic induction of flux density (1 Tesla = 10^4 Gauss).

2.119 Test Pieces

See Control Specimens (2.26).

2.120 Threading Bar Method

A method of magnetization in which a current carrying bar, cable or tube is passed through a bore or aperture in a component under inspection.

2.121 Threading Coil Method

A development of the threading bar method whereby a magnetizing coil rather than a straight run of bar or cable is threaded through a bore or aperture in a component.

2.122 Tongs

An accessory consisting of two insulated conductors crossing each other at a common pivot, on one side of the pivot they form the two halves of a single turn magnetizing coil and on the other, two handles whereby the coil is made and broken and is connected to the source of current.

2.123 Ultra Violet Light

See Black Light (2.7).

2.124 Visible Particles

See Colour Contrast Particles (2.18).

2.125 Wet Particle Method

The magnetic particle inspection method employing ferromagnetic particles suspended in a liquid bath.

2.126 Yoke

A magnet that induces a magnetic field in the area or a part that lies between its poles. Yokes may be permanent magnets or either alternating current or direct current electromagnets or half wave direct current.

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